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Blenderized Tube Feeding: Suggested Guidelines to Clinicians



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Blenderized tube feeding has been gaining momentum among patients despite the availability of commercially prepared and nutritionally complete enteral formulas. There is little published research on the efficacy of this feeding option, yet before commercial formulas, this was the only option. This article will review perspectives and provide clinicians with basic guidelines for planning and implementing blenderized enteral feedings when our patients request this feeding option.

INTRODUCTION

Before the availability of commercial enteral formulas, “blenderized” foods were prepared in hospital kitchens to create liquid mixtures given by bolus syringe method through large-bore nasogastric and gastric tubes. As technology continued to advance in the 1970s, commercial formulas of defined composition were introduced for tube feedings.¹ Blenderized tube feeding (BTF) became a less desirable option when commercial formulas became more affordable, easy to use, and widely available. The risk of microbial contamination and labor intensity were the primary reasons BTF were abandoned by most healthcare facilities. Commercial enteral formulas are packaged aseptically and are approved to hang for 48 hours as a closed system reducing administration error and time involved with tube feeding. Unfortunately, the only

tubing available in the U. S. for use with these products *cannot* hang for more than 24 hours (so this touted 48 hour benefit is not really a benefit). Studies have demonstrated that the microbial quality of hospital-prepared BTF was not within the published guidelines for safety.²⁻³ However, in many parts of the world, especially in developing countries, the use of hospital-prepared formula is a routine practice due to economic or cultural reasons.²⁻⁴

Compared with commercial formulas, preparation of BTF can be labor intensive and the cost (is rarely, if ever) covered in medical plans. In addition, there are food safety concerns and uncertainty about the nutritional value of non-standardized recipes. For these reasons, clinicians are hesitant to recommend this option to an already stressed and exhausted patient and /or caregiver. Several studies have shown that hospital-prepared formulas provided unpredictable levels of macro and micronutrients, delivered less than the desired amounts of nutrients, and increased the risk of

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tube occlusion due to viscosity, making it unsuitable for reliable infusion through feeding tubes.^{2,4}

However, there remains a subset of the population who are interested in this feeding option. BTF has been gaining popularity among home enteral nutrition (HEN) patients, particularly the pediatric population. Many patients and families choose BTF because of perceived health benefits, intolerance to commercial feeding formulas, food allergies, improved bowel function, psychosocial reasons, or personal preference (desire for “real” food, organic, vegetarian, etc.).⁵⁻⁶

Use of Blenderized Tube Feeding

BTF is defined as the use of blended foods and liquids given directly via the feeding tube. Historically, these types of enteral formulas have been called “blended diet”, “blenderized feeding,” “blended formula,” or “homemade blended formula.” The practice of incorporating BTF into a feeding regimen could be a combination of a commercial formula and commercial pureed baby food, or three meals a day of homemade blenderized foods supplemented by nocturnal feeding of a commercial formula, or complete feedings using homemade BTF made from recipes, and many variations in between. The introduction of ready to use BTF in the marketplace has also provided HEN patients with an option over commercial enteral formulas. Regardless of how a patient uses BTF, it is essential to identify a commercial enteral formula for emergency situations, or when traveling when refrigeration is not available.⁷

There is little published research available to support the efficacy of BTF that translate into any type of beneficial outcomes of this feeding technique. There are numerous anecdotal reports from patients, caregivers, and medical professionals of positive experiences that have been shared through informal patient questionnaires, feeding support groups on the internet, social media, professional discussions and clinical experiences.⁵⁻⁹

One feeding clinic reported both medical and emotional benefits from the use of BTF.⁷ It allowed for some normalization of the feeding process for gastrostomy tube-fed patients, greater volume tolerance, and improvement in reflux and constipation, and it facilitated the transition from tube to oral feeding. The use of blenderized foods allowed for inclusion of a tube-fed patient in family mealtimes and a sense of “normalization” of gastrostomy tube feedings. It also

Table 1. Factors to Consider Before Using Blenderized Tube Feeding^{5,7,9}

- Medically stable HEN patient
- Medical team support
- Dietitian support and availability for guidance and direction
- Patient/family demonstrate understanding of good food practices, importance of clean equipment, etc.
- Size of Gastrostomy tube is ≥ 14 French
- G tube site has matured, healed with no infection
- Patient with proven tolerance to bolus feedings
- Availability of bolus extension set for low-profile G tubes
- Stable on commercial enteral formula (unless there is severe tolerance issue with commercial formulas)
- Patient/family motivated and willing to commit the time to prepare BTF
- Ability to follow recipe instructions and meet food safety guidelines
- Adequate financial and material resources (refrigeration, heavy-duty blender, air tight storage containers, clean water supply, food, multivitamins)
- HEN patient with jejunal feeding tube should seek medical permission

promoted the view of the G tube as another mouth, thereby priming the gastrointestinal system for the complexities of food.

The interdisciplinary feeding team at the Cincinnati Children’s Hospital Medical Center (CCHMC) conducted a feeding trial using a pureed diet given directly into the feeding tube, referred to as the pureed by gastrostomy tube (PBGT) diet. It was designed for children with gagging and retching after fundoplication surgery.⁸ This was the first clinical trial using BTF

Table 2. Obtaining Enteral Formula from the Oley Foundation

1. Check the Oley website: www.oley.org/equipexchange.html for a complete list of donated products.
2. Send a list of product(s) needed to oleyequipment@aol.com or call (866) 454-7351 to confirm the product is still available. HEN patient/caregiver will be provided with donor's contact information.
3. HEN patient/caregiver is required to arrange and cover the cost of shipping the donation.
4. Shipping options: UPS (800) 742-5877 or Federal Express (800) 463-3339
5. Things to consider: Each case of enteral formula weighs approximately 17 lbs. and shipping may cost \$20 per case depending on the distance.
6. Make sure to inform the Oley equipment/supply exchange program after receipt of donated formula to keep the list of available items updated.

to manage the complications associated with enteral feeding. Fifty-two percent of parents reported a decrease in gagging and retching after their child started the PBGT diet and 57% of children were reported to have an increased oral intake.⁸

When to Consider Blenderized Tube Feeding

Table 1 outlines the prerequisites before seriously considering the use of BTF. Ideally, a clinician must first determine if a patient is a good candidate for BTF. However, a tube-fed patient may already have transitioned to either partial or full homemade BTF regimen before a referral is made. Working with a dietitian is essential to ensure that the homemade diet is adequate and whether the current homemade BTF recipe plan needs modification. The best candidate is a patient and/or caregiver who made the decision to "try" this feeding option, and is willing to commit their time and effort for instruction and preparation of BTF. A patient who is having tolerance issues or allergy to a commercial enteral formula may also be a candidate after discussion with the medical team and dietitian.

When Not to Consider Blenderized Tube Feeding

BTF is not an option for all tube-fed patients. Patients with complicated medical and gastrointestinal issues and those who require frequent hospitalization may not tolerate and sustain a BTF regimen. Often, these patients require specialized enteral formulas. A patient who requires continuous feeding is not a good candidate since a homemade blended formula is not recommended for feedings that will last for more than 2 hours due to concerns over food safety and bacterial contamination.⁵

Homemade BTF is generally thicker and can potentially clog the feeding pump making it difficult to flow through the feeding set. Some patients have successfully infused BTF through a feeding pump as long as the mixture is thinned with additional fluid, blended, and strained sufficiently. Bolus syringe method works best and provides the pressure needed to move a homemade blended formula down a feeding tube. It is recommended for gastrostomy tubes 14 French size or larger to prevent clogging and for ease of administering the diet.

Tools for Success

- Heavy duty blender
 - Blendtec® HP3 blender: www.blendtec.com (800) 253-6383
 - Vitamix®: Inquire about Vitamix® Medical Needs Discount Program which is available to all eligible candidates at (800) 848-2469 or email: household@vitamix.com reference code 07-0036-0011
- Strainer or fine sieve if using a regular kitchen blender or stick blender (see Figure 1)
- Airtight storage containers, ice cube trays for freezing individual portions
- Adequate refrigeration/ freezer space
- 60 mL syringe with plunger
- Bolus extension set for low-profile gastrostomy tube
- Feeding pump (if using)

Table 3. Commercial Ready to Use Blenderized Tube Feeding Products

Nutrients	Liquid Hope™	Real Food Blends™ (3-meal varieties)	Compleat®
Serving size	360 mL (foil pouch)	237 mL (foil pouch)	250 mL carton
Calories (Kcals)	440	330-340	265
Protein (g)	23	11-14	12
Fat (g)	19	18-20	10
Carbohydrate (g)	47	28-32	33
Dietary fiber (g)	10	2.2- 4.4	1.5
Water (%)	63	75-80	85
Cost/1000 Kcals	\$18.16	\$12.42	\$15.09

- Make sure BTF is thin enough to flow easily through the pump
- Discard BTF after 2 hours maximum if kept at room temperature for that long
- Insulated bag or ice chest with ice packs when traveling
- Patient education on food safety guidelines (www.fsis.usda.gov, www.foodsafety.gov, www.homefoodsafety.org)
- USDA Choose My Plate <http://www.choosemyplate.gov/supertracker-tools/supertracker.html>
The supertracker feature provides individualized worksheets where a profile can be created to calculate and track a menu plan. A sample 1000 calorie meal plan will include:
 - Grains: 3 servings
 - Fruits: 1 serving
 - Vegetables: 1 serving
 - Protein (meat, beans, or nuts): 2 servings
 - Milk or milk substitute: 2 servings
 - Fats: 3 servings

Getting Started with a Homemade Blenderized Tube Feeding

- Evaluate the patient’s medical history, success (or not) with current feeding regimen (feeding tube, oral intake), food tolerances, lifestyle/ethnic/religious preferences, ability to obtain individual ingredients and tools needed for preparing a homemade BTF.
- Discuss with medical team and determine if patient is ready to start the transition. Most patients transition slowly and use a commercial formula for part of nutrient requirements.
- Determine goals for calories, protein, fluids, and vitamin, mineral, and electrolyte supplementation.
- Develop a meal plan and starter recipe. The following tools can be used as starting point to create a meal plan based on caloric goals:
 - Homemade blended formula worksheets by Dunn Klein M, Morris SE. Homemade blended formula handbook. Mealtimes Notions, LCC, Tucson, AZ, 2007; 117-128; www.mealtimesnotions.com
The worksheets were adapted from the USDA My Pyramid.
 - Sample Blenderized Tube Feeding Recipes at www.ginutrition.virginia.edu under Resources for Nutrition Support Clinicians

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- Nutrition and recipe analysis applications. Computerized nutrition programs such as Food Processor®, Nutritionist Pro™ allows the clinician to add and modify foods while monitoring the total caloric and protein levels along with vitamin and mineral profile. The clinician can save and retrieve the data for future reference.
- USDA National Nutrient Database for Standard Reference: <http://www.nal.usda.gov/fnic/foodcomp/search>
- Exchange Method
- Food company websites/food labels
- Determine macronutrient food sources. The following examples work well in blenderized tube feedings:
 - Grains: cooked cereals, boiled white or brown rice, cooked quinoa, oats, regular or whole grain bread
 - Fruits: avocado, applesauce, peach, pear, banana, papaya, blueberries, 100% fruit juice (pulp free). Commercial pureed baby food (stage 2) can be used for variety, consistent nutritional value, and it also avoids the potential complication of clogging the feeding tube. It is convenient especially when traveling, and avoids the need to purchase an expensive heavy-duty blender. The patient can eventually advance and transition to blenderized table foods.
 - Vegetables: white potato, sweet potato, carrots, squash, well-cooked broccoli. Can use commercial pureed baby food (stage 2).
 - Protein: chicken, beef, legumes, soft tofu, smooth 100% peanut butter, cooked eggs, canned tuna or other fish without bones. A commercial enteral formula can be used as the base for a blended diet instead of meat, milk, or yogurt as the sole protein source (see Table 2). Milk and yogurt tend to blend more easily than cheese.
 - Milk or milk substitute: cow's milk, soy milk, almond milk, rice milk, yogurt, non-fat milk powder.

Figure 1. Stick Blender



- Fats: canola, olive, flaxseed, hemp and corn oils.
- Example of a 1000 calorie blend:
 - Grains: 1 cup cooked oatmeal and ½ cup cooked brown rice
 - Fruits: ½ cup peaches (canned or fresh) and ½ cup unsweetened apple juice
 - Vegetables: ½ cup cooked carrots and ½ cup cooked sweet potato, butternut squash or pumpkin
 - Protein: 2 ounces cooked chicken
 - Dairy: 1 cup whole milk and 1 cup yogurt (plain)
 - Fats: 3 tsp olive oil
- Review and modify the recipe using a recipe analysis program to adjust the ratios of macronutrients to the desired composition.
 - A modular product (glucose, MCT oil, protein, fiber such as Benefiber®) can be added to enhance the nutrient profile of blenderized enteral feedings.

Table 4. Additional Resources on Blenderized Tube Feeding**General**

- Complete Tube Feeding: everything you need to know about tube feeding, tube nutrition, and blended diets by Eric Aadhaar O' Gorman, 2012, www.completetubefeeding.net
- Coping Well with Home Enteral Nutrition by Cheryl Thompson, PhD, RD, www.copingwell.com/copingwell
- Feeding Tube Awareness Foundation: non-profit organization dedicated to promote awareness and provide parents and caregivers of a child who is tube-fed, www.tubefeedingawareness.org

Recipes

- Homemade Blended Formula Handbook by Marsha Dunn Klein MEd., OTR/L and Suzanne Evans Morris, PhD, CCC-SLP, 2007, available for purchase at www.mealtimenotions.com
- Making your own food for tube feeding: www.oley.org/lifeline/TubetalkS007.html
- Sample Blenderized Tube Feeding Recipes at www.ginutrition.virginia.edu under Resources for Nutrition Support Clinicians
- Food for Tubies is a blended food resource group at www.foodfortubies.org
- Seattle Children's: Homemade Blenderized Tube Feeding, www.seattlechildrens.org
- Complex Child e-magazine articles on GI and Nutrition at www.complexchild.com/gi.html

Food Allergies

- Adult Allergies and Enteral Nutrition Tables for Selected Allergies by Kendra Glassman, MS, RD, CNSC, www.ginutrition.virginia.edu under Resources for Nutrition Support Clinicians
- Groetch M. Food Allergies: Dietary Management. *Practical Gastroenterology* 2013;XXXVII(11):46.
- Henry M. Nutrition Guidelines for Treatment of Children with Eosinophilic Esophagitis. *Practical Gastroenterology* 2014;XXXVIII(6):21.

- Determine fluid goals. The percentage of free water is calculated from the blended recipe by multiplying the total volume of fluid-containing ingredients (commercial formula, meats, fruits, vegetables, milk, and yogurt) in ounces by 0.75. This is based on the assumption that most infant foods contain roughly 75% free water (9). Additional free water is determined from the difference between estimated daily fluid requirement and amount of free water of the blended recipe.
- Determine need for vitamin, mineral, and electrolyte supplementation. Perform a recipe analysis. Request labs as appropriate for any nutrients of concern. A multivitamin may be crushed and added to one of the bolus feeds. A liquid multivitamin is an option, but is not always complete—make sure patient gets the right one. Oral rehydration solution (ORS) can be given instead of free water flushes between bolus feeds.
- Patient and/or caregiver education
 - meal plan, ingredients, starter recipe
 - equipment: blender, strainer, 60 mL syringe, storage containers
 - preparation details
 - proper sanitation method
 - proper storage and refrigeration
 - administration method and feeding schedule (bolus syringe, pump)
 - water or oral rehydration solution flushes
 - vitamin/mineral/electrolyte supplementation if needed
 - travel/emergency plan

- Patient monitoring and follow-up. Schedule call-back, follow-up visit to monitor weights/weight changes, modify/adjust BTF recipe.

Commercial Ready to Use Blenderized Tube Feeding Products — See Table 3

- Liquid Hope™. Ready to use organic whole foods. The manufacturer recommends switching to Liquid Hope™ slowly, one meal per day until the transition is complete. The unopened formula is shelf stable for up to 2 years. It has a 3-hour room temperature hold time and unused formula can be refrigerated for 48 hours. The formula can be diluted with water to achieve the desired consistency. Patients can order online (\$7.99 per 12-oz serving; available in units of 6, 12, or 24). Medicare approved code for this product is B4149 (blenderized natural foods with intact nutrients).

<http://www.functionalformularies.com>

- Real Food Blends™. Pre-made blenderized meals, available in 3-meal varieties (Salmon Oats and Squash, Orange Chicken Barley and Carrots, Quinoa Kale and Hemp) and is shelf stable for 18 months. Unused formula should be refrigerated and used within 24 hours. The quinoa meal is slightly thicker and may require additional fluid to flow easily. Patients can order online (\$49.95 for 12-pack meals); approved by CMS HCPCS for code B4149 (blenderized natural foods with intact nutrients).

<http://www.realfoodblends.com>

- Compleat®. Formulated with real food ingredients: chicken, peas, carrots, tomatoes, and cranberry juice. Available in 250 mL carton and 1 liter closed system. HCPCS code B4149 (blenderized natural foods with intact nutrients). <http://www.nestlehealthscience.us/products/compleat>

Use of Blenderized Tube Feeding and the New ENFit Connectors

The new enteral connector (ENFit) system is being introduced in phases and is expected to be completed in 2015. GEDSA (Global Enteral Device Supplier

Association), Kimberly-Clark, and A.S.P.E.N. (American Society for Parenteral and Enteral Nutrition) recently conducted experiments to determine the pressure required to dispense a BTF through a 60 mL syringe (catheter tip and ENFit) and to check the gravity flow (mL/min) of BTF through the connectors.¹⁰ The BTF was tested just coming out of the refrigerator to simulate clinical conditions. It took about the same pressure to push the BTF through the catheter tip and ENFit syringe, but was actually easier with the ENFit connector. The testing also showed that the gravity flow (mL/min) of BTF for ENFit and catheter tip syringes were essentially equivalent through two gastrostomy tubes (Kimberly-Clark 18fr/20fr PEG with solid bolster and balloon retained G tube feeding systems).

SUMMARY

The process of transitioning to BTF can be an overwhelming task for both the patient and clinician. Homemade blended diets are often described as nutritionally unbalanced, have increased risk for food contamination, and may compromise the enteral access devices. BTF can be used for partial, supplemental, or complete nutrition support. It can be safely used and implemented with the involvement of the medical team and support from the RD to assess, educate, and monitor the patient's progress toward this feeding option. See Table 4 for additional resources. ■

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